Homework 3

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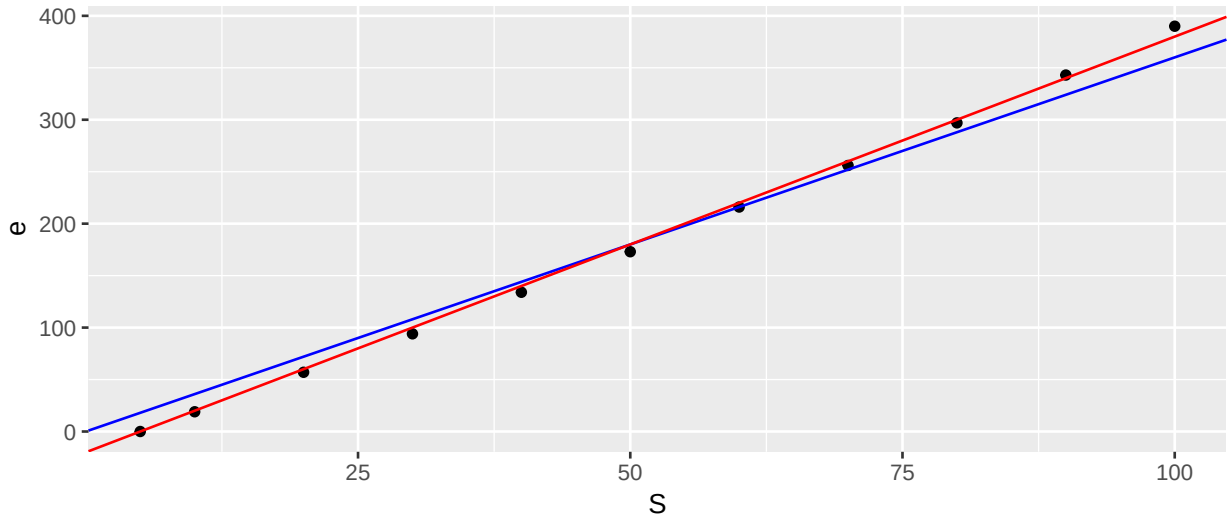
1 Problem : Page 113: 2

The following table gives the elongation e in inches (in./in.) for a given stress S on a steel wire measured in pounds per square inch (lb/in.^{2}). Test the models $e = c_1 S$ by plotting the data. Estimate c_1 graphically.

Table 1:

$S(x10^{-3})$	5	10	20	30	40	50	60	70	80	90	100
$e(x10^5)$	0	19	57	94	134	173	216	256	297	343	390

```
library(ggplot2)
S <- c(5,10,20,30,40,50,60,70,80,90,100)
e <- c(0,19,57,94,134,173,216,256,297,343,390)
ggplot(data = as.data.frame(cbind(S,e)), aes(x = S, y = e)) +
  geom_point() +
  geom_abline(slope = 3.6, color = 'blue') +
  geom_abline(intercept = -20, slope = 4, color = 'red')
```



Above is the graph of the elongation $e% versus stress S x 10^{-1}. By eyeballing the results of several plots we can give the estimate of ~3.6 for c_1 for the model $e = c_1 S$ (this is the blue line). However, do see a much better fit with ~4 for c_1, if we provide an intercept of -20. These are simply best guesses.

2 Problem : Page 121: 2.a

For each of the following data sets, formulate the mathematical model that minimizes the largest deviation between the data and the line y= ax+b. If a computer is available solve for the estimates of a and b.

Table 2:

x	1	2.3	3.7	4.2	6.1	7.0
y	3.6	3.0	3.2	5.1	5.3	6.8

3 Problem : Page 127: 10

Data For planets

Body	Period (sec)	Distance from sun (m)
Mercury	7.60 x 10^6	5.79 x 10^10
Venus	1.94 x 10^7	1.08 x 10^11
Earth	3.16 x 10^7	1.5 x 10^11
Mars	5.94 x 10^7	2.28 x 10^11
Jupiter	3.74 x 10^8	7.79 x 10^11
Saturn	9.35 x 10^8	1.43 x 10^12
Uranus	2.64 x 10^9	2.87 x 10^12
Neptune	5.22 x 10^9	4.5 x 10^12

4 Problem : Page 136: 7

a. In the following data, W represents the weight of a fish (bass) and l represents its length. Fit the model $W = kl^3$ to the data using the least-squares criterion.

Table 3:

Length, l (in.)	14.5	2.3	3.7	4.2	6.1	7.0
Weight, W (oz)	3.6	3.0	3.2	5.1	5.3	6.8

5 Problem : Page 146: 5

Solve Problems 1 - 4 with the model V = m(log P) + b. Compare the errors with those computed in Problem 4. Compare the two models. Which is better?

6 Problem : Page 157: 4

7 Problem : Page 169: 11

8 Problem : Page 181: 5